2600.024

REPORT

MONSANTO COMPANY

J.F. QUEENY PLANT

BUILDING FF

PHASE I INVESTIGATION

Prepared by:

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ST. LOUIS, MISSOURI

JULY 1993

REPORT

J.F. Queeny Plant
Building FF
Phase I Investigation

Monsanto Company
St. Louis, Missouri

July 1993

O'BRIEN & GERE
ENGINEERS, INC.

MONSANTO COMPANY
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SECTION 1 - INTRODUCTION

1.01 Site Location

The Monsanto Company (Monsanto) J.F.Queeny Plant is located in St. Louis, Missouri, just west of the Mississippi River in the southeast portion of the city at 1700 South Second Street. A topographic site location map is included as Figure 1. Building FF of the J.F. Queeny Plant was formerly located within the block located on the northeast side of the intersection of Russell Avenue and South Second Street (see Figure 2).

1.02 Site Background

Building FF was dismantled in 1992. Monsanto previously had installed four (4) product recovery wells to recover free product from a leaking underground storage tank (UST) containing tetrachloroethene (PCE). The UST was formerly located on the northwest side of Building FF. In addition, one (1) groundwater monitoring well is located in the immediate vicinity of former Building FF.

In May 1993, O'Brien & Gere Engineers, Inc. was retained by Monsanto to perform an investigation of the groundwater and the soil in the area where Building FF was located. The investigation included the collection of seventeen (17) groundwater samples using GEOPROBE® sampling methods; five (5) groundwater samples, one (1) each from the four (4) existing groundwater recovery wells and groundwater monitoring well MW-3; and ten (10) subsurface soil samples. The groundwater samples collected using GEOPROBE® sampling methods were analyzed by GeoTrace, Inc. using a field gas chromatograph (GC) by headspace analysis. The groundwater samples collected from the existing wells and the soil samples were analyzed by Savannah Laboratories and Environmental Services, Inc. (Savannah Laboratories) in Savannah, Georgia, using EPA method SW-8240 for PCE and trichloroethylene (TCE).

SECTION 2 - FIELD INVESTIGATION

2.01 GEOPROBE® Groundwater Sampling

O'Brien & Gere Engineers, Inc. and GeoTrace, Inc. collected seventeen (17) groundwater samples from the Building FF investigation area on May 26 and 27, 1993. Figure 2 depicts the GEOPROBE® sample locations.

The groundwater samples were collected using a GEOPROBE® machine to hydraulically drive a slotted probe into the subsurface. The probe was driven into the ground until water was detected inside the probe. A groundwater sample was then collected from the probe by using polyethylene tubing and a ball valve on the end of the tubing. Each groundwater sample was transferred to two (2) 40 milliliter (ml) vials with teflon septa lids and placed on ice until sample preparation and analysis. The samples were analyzed using a field GC. Each sample was prepared for analysis by transferring approximately 20 ml of the sample into another 40 ml vial which was then sealed. This vial was placed in a block heater and heated approximately twenty (20) minutes. A headspace sample was then drawn out of the vial and injected into the field GC for analysis.

During the process of driving the probes, refusal was occasionally encountered. Where refusal was encountered, a new location in the general area of the original sample attempt was selected and another attempt to drive the probe was made. This process was repeated until the probe could be driven to the water table without encountering refusal. Four GEOPROBE® sample locations, GP-13, GP-15, GP-17, and GP-19, had to be abandoned due to refusal (Figure 2).

During the collection of the groundwater samples, an additional GEOPROBE® sample location, GP-21, was selected, as recommended by Monsanto. This location was added to fill the apparent data gap between GP-9 and MW-3 (see Figure 2).

During the collection of the GEOPROBE® groundwater samples, personnel and environmental monitoring was conducted. Personnel were monitored for heat stress at two (2) hour intervals. Heat stress monitoring consisted of measuring the pulse rate and oral temperature of O'Brien & Gere Engineers, Inc. personnel on site and O'Brien & Gere Engineers, Inc. subcontractors on site. Environmental monitoring was also conducted on site. The environmental monitoring consisted of using a photoionization detector (PID)

with an 11.7 eV lamp to screen the breathing zone. The environmental monitoring was conducted at thirty (30) minute intervals while personnel were on site.

2.02 Groundwater Sampling

On June 3 and June 4, 1993, O'Brien & Gere Engineers, Inc. collected the groundwater samples from the four (4) product recovery wells; and on June 10, 1993, the groundwater sample from MW-3 was collected. Copies of the groundwater sampling field logs are included in Appendix A.

Groundwater samples were collected from the product recovery wells and MW-3 by first removing the flange or well cover from the top of the well. After the flange or well cover was removed, each well was immediately screened with a PID to assess the presence of volatiles in the well. Results from screening the wells with the PID can be found in Table 2. After screening the well with the PID, a weighted cotton string was lowered to the bottom of the well and then removed to assess the presence of a dense non-aqueous phase liquid (DNAPL) layer. No DNAPL layers were detected in any of the wells using this method. After a well had been screened for volatiles and DNAPL layers, the depth of the water column in the well was measured using a water level probe and the volume of water in the well was calculated. A Westinghouse arch pump was used to purge the well prior to sampling. When three (3) times the calculated well volume had been purged from the well, conductivity, pH, and temperature readings of the well water were measured until three (3) consecutive consistent readings for each of the parameters were obtained. When these readings were obtained, a polyethylene disposable bailer was used to collect the sample. The samples were transferred to four (4) 40 ml vials. The samples were placed on ice and then shipped to Savannah Laboratories for analysis of PCE and TCE by EPA Method SW-8240.

While collecting the ground water sample from REC-3, it was noted that water was entering the manhole from an apparent crack between the wall and the bottom of the manhole. Furthermore, the water contained in the manhole around the well casing was entering the well at a steady flow rate through a hole in the side of the well casing.

During the collection of the groundwater samples from the product recovery wells, confined space entry protocol was followed whenever the manhole in which the wells were located was entered. Also, while sampling the product recovery wells and MW-3,

environmental and personnel monitoring was conducted. Environmental monitoring consisted of monitoring the breathing zone for volatiles and the confined space for oxygen content, explosivity, and volatiles. The PID was used for monitoring for volatiles; an oxygen meter was used to measure percent of oxygen in the breathing zone; and, an explosimeter was used to measure the percentage of the lower explosive limit (LEL) in the breathing zone. The personnel monitoring consisted of monitoring the temperature and pulse rate of O'Brien & Gere Engineers, Inc. personnel involved in on site activities, approximately every two (2) hours.

2.03 Subsurface Soil Sampling

On June 10, 1993, O'Brien & Gere Engineers, Inc. and Layne Western, Inc. completed five (5) soil borings and collected subsurface soil samples for analysis. The locations of the soil borings were determined from the results of the GEOPROBE® ground water samples. SB-2 and SB-4 were located in the apparent source area to assess the source concentrations of TCE and PCE in the soil. SB-1 and SB-5 were located on the western boundary and the northern boundary, respectively, to assess the concentrations away from the apparent source in an attempt to define the limits of the soil contamination. SB-3 was located on the southeastern portion of the site in an assumed background location. The locations of the borings are depicted on Figure 2.

The soil borings were collected using a hollow stem auger and a standard split spoon sampler. Continuous split spoon sampling was performed at two-foot intervals. The soil was characterized and field screened with a PID (10.2 eV lamp) in ziplock plastic bags. Two (2) soil samples per boring were preserved for laboratory analyses. The rationale for determining which soil samples would be submitted for laboratory analyses was to select a near surface sample (between 2 and 4.5 feet from grade) to aid in assessing possible TCE and PCE source areas and then select the interval from which the highest PID reading was obtained between surface grade and the saturated groundwater zone. Initially, the 1-foot to 3-foot range was selected for the near surface sampling range; however, a sample from the 2-foot to 4.5-foot range was collected in the field because of the gravelly fill that was encountered in the upper two (2) feet of overburden. The boring, SB-3, could not be sampled according to this methodology. the upper 9.5 feet of the encountered overburden consisted of coarse, porous granular fill. Because of the coarse materials, split spoon sample

recovery was poor in the upper 6.5 feet of overburden. In addition,the fill material encountered was saturated below a depth of approximately 18 inches from grade. Therefore, a representative sample from the fill material (SB-3, 6.5'-8.5') and a representative sample from underlying silty clays (SB-3, 10.5'-12.5') were collected and preserved for laboratory analysis.

PID readings of SB-2 ranged from a low of 10 ppm for the 10'-12' interval to a high of 400 ppm for the 2'-4' interval. The remaining four borings generally had PID readings below 10 ppm. Copies of boring logs from the field observations and PID screening are included as Appendix B.

During the collection of the subsurface soil samples, environmental and personnel monitoring was conducted. The environmental monitoring consisted of monitoring the breathing zone with an explosimeter, oxygen meter, and a PID. The personnel monitoring included monitoring the pulse rate and temperature of the O'Brien & Gere Engineers, Inc. personnel and Layne Western, Inc. personnel on site.

SECTION 3 - ANALYTICAL RESULTS

3.01 GEOPROBE® Groundwater Sampling Results

The GEOPROBE® groundwater sample results which were analyzed by the field GC unit are presented in Table 2. The results for TCE ranged from 2 parts per billion (ppb) to 45,974 ppb, and the PCE concentrations ranged from 7 ppb to 12,486 ppb. A duplicate sample (GP-3 DUP) was collected from GP-3 and analyzed for TCE and PCE. The concentrations of TCE and PCE in GP-3 and GP-3 DUP were identical. The concentrations of TCE and PCE were 2 ppb and 7 ppb, respectively. The higher concentrations of TCE and PCE were detected in the area of the former UST which contained PCE. In eight (8) of the samples, other unknown analytes were detected. A copy of the GeoTrace, Inc. report is included as Appendix C.

3.02 Well Sampling Results

The analytical results for the groundwater samples collected from the product recovery wells and MW-3 can be found in Table 3. The concentrations of TCE ranged from <5.0 ppb to 570 ppb. Due to the high PCE concentrations present in samples REC-1 and REC-2, the quantitation limits for TCE in these samples were raised to 2,500 ppb and 5,000 ppb, respectively. The concentrations of PCE ranged from 36 ppb to 150,000 ppb. A duplicate sample (DUP) was collected from REC-4 and analyzed for TCE and PCE. The detected TCE concentrations were 570 ppb in REC4 and 380 ppb in the duplicate sample. The detected PCE concentrations were 3,400 ppb in REC-4 and 3,300 ppb in the duplicate sample. The highest PCE concentrations were detected in the recovery wells REC-1 and REC-2, located north to northeast of the former PCE UST location.

3.03 Subsurface Soil Sampling Results

The analytical results for the subsurface soil samples can be found in Table 4. The concentrations of TCE ranged from 6.5 ppb to 21,000 ppb and the PCE concentrations ranged from 8.9 ppb to 2,000,000 ppb. A duplicate sample was collected from SB-2 at the 2'-4' interval and analyzed for TCE and PCE. The duplicate sample was identified as SB-6, 2'-4' to serve as a blind duplicate and prevent bias during sample analysis. The detected TCE concentrations were <63,000 ppb for SB-2 (2'-4') and <840 ppb in the duplicate

sample. The detection limit for TCE was raised due to the high PCE concentrations present in the samples. The detected PCE concentrations were 2,000,000 ppb for SB-2 (2'-4') and 3,100 ppb in the duplicate sample. The apparent disparity between the analytical results is most likely due to nonhomogeneity of the soil. The higher concentrations were detected near the former UST which contained PCE.

Table 1

Monsanto Company
J.F. Queeny Plant
Building FF
Phase I Investigation

PHOTOIONIZATION DETECTOR (PID) WELL SCREENING RESULTS
(ppm)

Well I.D.	PID Reading
REC–1	0.0
REC–2	5.0
REC–3	0.0
REC–4	0.0
MW–3	0.0

Table 2

Monsanto Company
J.F. Queeny Plant
Building FF
Phase I Investigation

GEOPROBE GROUNDWATER SAMPLING RESULTS
(ug/L)

Sample I.D.	Parameter	
	Trichloroethene	Tetrachloroethene
GP1	341	151
GP2	10,785	3,880
GP3	2	7
GP3 DUP	2	7
GP4	21	28
GP5	574	890
GP6	45,974	5,486
GP7	1,042	3,220
GP8	37,840	9,416
GP9	2,736	414
GP10	771	144
GP11	18,414	6,221
GP12	5,442	3,883
GP14	12	12
GP16	337	12,486
GP18	132	36
GP20	478	23
GP21	3,563	4,360

NOTE:
1) ug/L is equivalent to parts per billion (ppb)

Table 3

Monsanto Company
J.F. Queeny Plant
Building FF
Phase I Investigation

WELL SAMPLING RESULTS
(ug/L)

Sample I.D.	Parameter	
	Trichloroethene	Tetrachloroethene
REC-1	<2,500	61,000
REC-2	<5,000	150,000
REC-3	<5	36
REC-4	570	3,400
MW-3	250	250
DUP	380	3,300

NOTE:
1) ug/L is equivalent to parts per billion (ppb)

Table 4

Monsanto Company
J.F. Queeny Plant
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Phase I Investigation

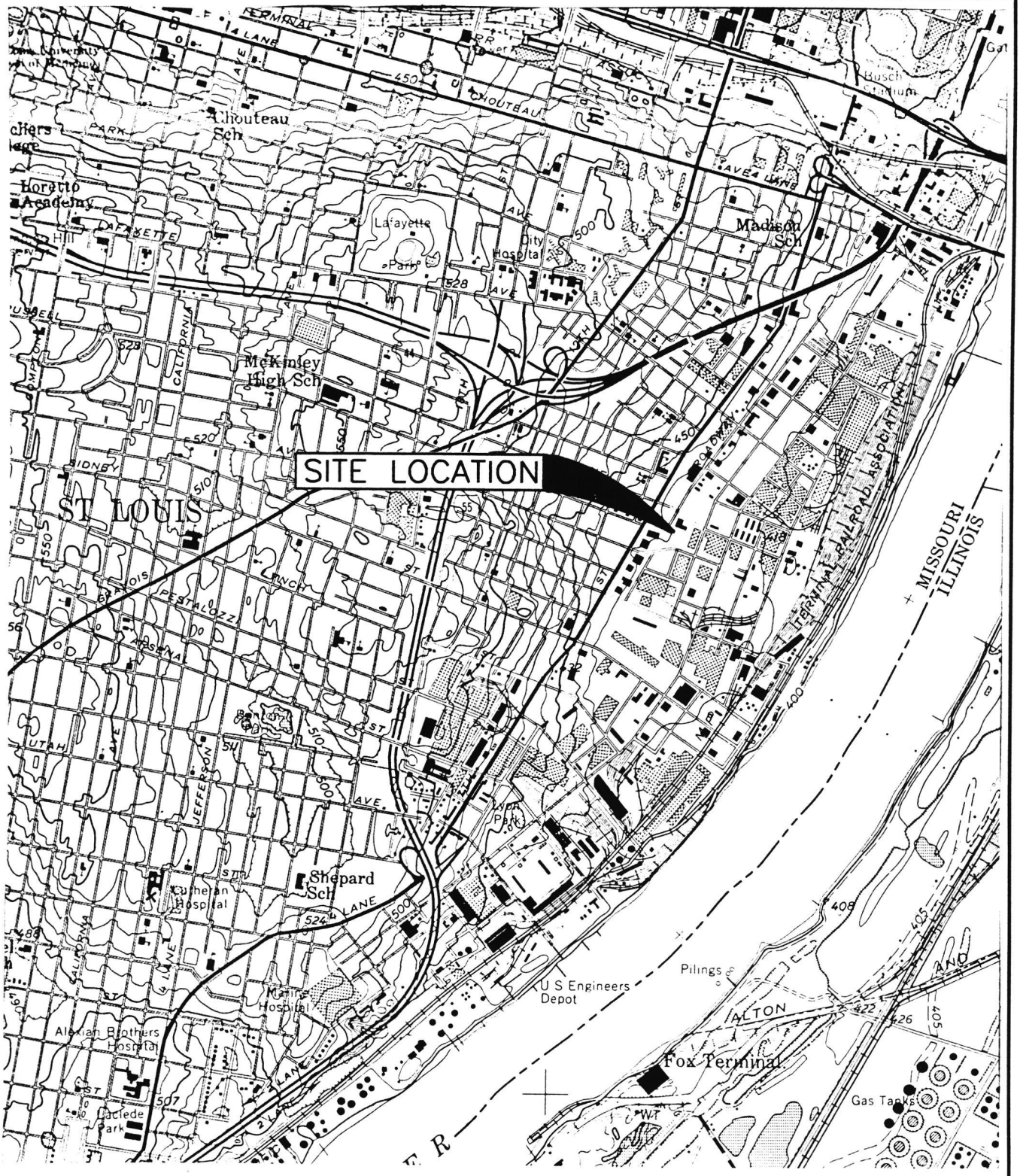
SUBSURFACE SOIL SAMPLING RESULTS
(ug/kg)

Sample I.D.	Parameter	
	Trichloroethene	Tetrachloroethene
SB-1 (2'-4')	<6.5	110
SB-1 (10'-12')	<770*	30,000
SB-2 (2'-4')	<63,000*	2,000,000
SB-2 (8'-10')	21,000*	280,000
SB-3 (6.5'-8.5')	760*	4,100
SB-3 (10.5'-12.5')	<6.8	93
SB-4 (2'-4')	1,000*	22,000
SB-4 (8'-10')	<32	390
SB-5 (2.5'-4.5')	<6.6	28
SB-5 (10.5'-12.5')	44	8.9
SB-6 (2'-4') DUP	<840*	3100

* Due to the high concentration of PCE in the sample, a high level extraction was employed which increased reported quantitation limits.

NOTE:
1) ug/kg is equivalent to parts per billion (ppb)

FIGURE 1



MONSANTO COMPANY
J.F. QUEENY PLANT
ST. LOUIS, MISSOURI
TOPOGRAPHIC SITE LOCATION MAP

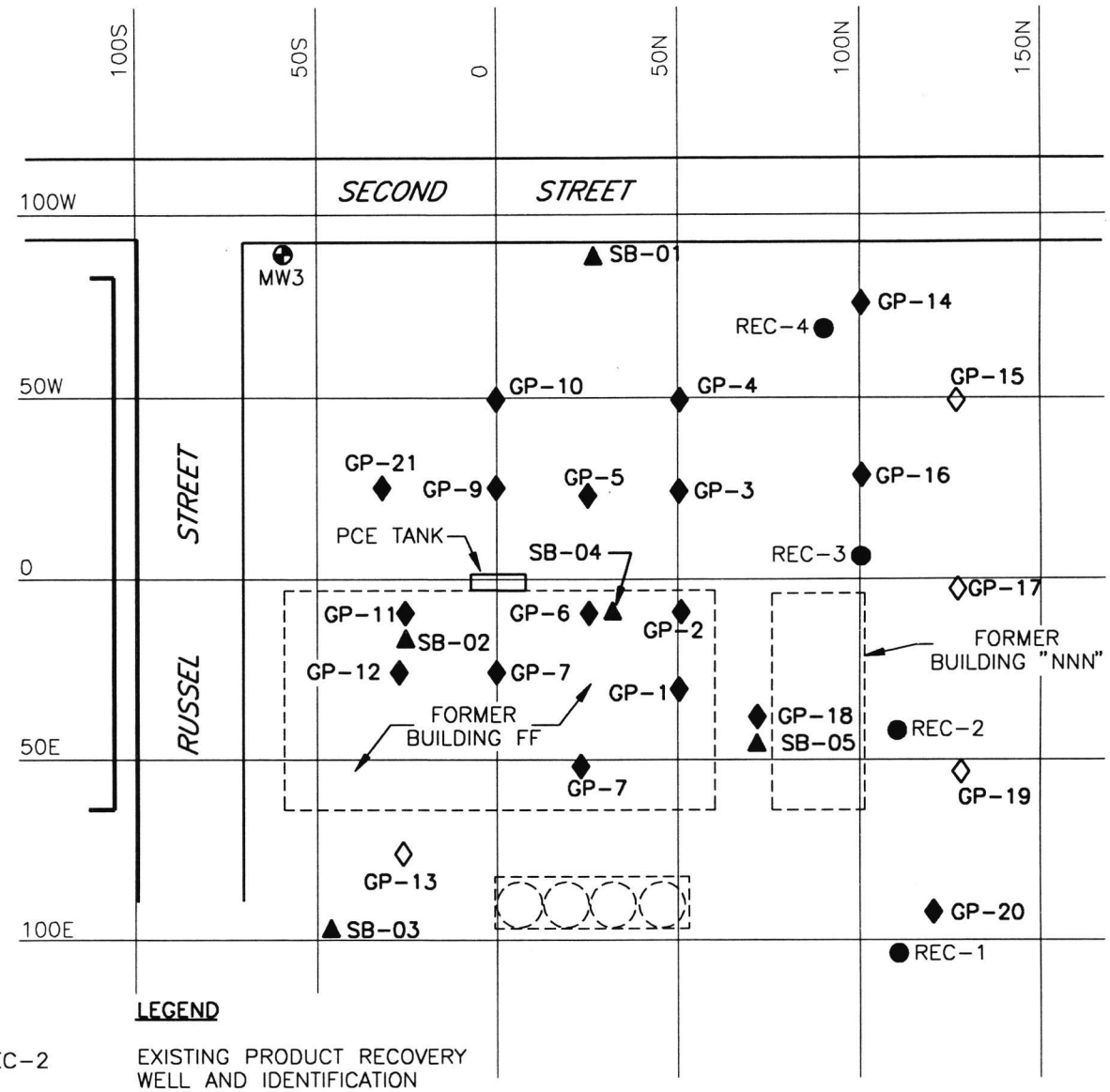
ADAPTED FROM U.S.G.S. (7.5 MIN)
CAHOKIA QUADRANGLE
SCALE 1:24,000
CONTOUR INTERVAL 10 FEET

2600.024-02F

O'BRIEN & GERE ENGINEERS INC.
St. Louis, Missouri

FIGURE 2

SCALE: 1" =50'-0"



LEGEND

● REC-2	EXISTING PRODUCT RECOVERY WELL AND IDENTIFICATION
⊕ MW3	EXISTING GROUND WATER MONITORING WELL AND IDENTIFICATION
♦ GP-4	GEOPROBE SAMPLE APPROXIMATE LOCATION AND IDENTIFICATION
▲ SB-03	SOIL SAMPLE APPROXIMATE LOCATION AND IDENTIFICATIION
◇ GP-19	ABANDONED GEOPROBE SAMPLE LOCATION AND IDENTIFICATION

MONSANTO COMPANY
J. F. QUEENY PLANT
BUILDING FF PHASE I INVESTIGATION

SAMPLE LOCATION PLAN

O'BRIEN & GERE ENGINEERS INC.
St. Louis , Missouri

2600.024-01F

APPENDIX A

GROUNDWATER SAMPLING FIELD LOGS

GROUND WATER SAMPLING FIELD LOG

JOB NO: 2600.024

Sample Location: J.F. Queeny Plant, Monsanto Co. Well No.: REC-1 Sampled By: MAH/JJL

Date: 3 June 93 Time: 1600 Weather: _____

Sampled With: X Bailer X Pump Completion: ____ Above Ground X Flush Mounted

A. WATER TABLE

Well Depth: (below ~~top of casing~~ Ground Surface) 33.55 ft. Well Elevation: (top of casing) _____ ft.

Depth to Water Table: (below ~~top of casing~~ Ground Surface) 9.0 ft. Water Table Elevation: _____ ft.

Length of Water Column (LWC): 24.55 ft.

Volume of Water in Well: 2" diameter wells = 0.163 x (LWC) = _____ gallons

4" diameter wells = 0.653 x (LWC) = 16.03 gallons x3 = 48.1 gallons

6" diameter wells = 1.469 x (LWC) = _____ gallons

B. PHYSICAL APPEARANCE AT START

Color Clear Odor none Turbidity Slight

Was an oil film or layer apparent? No

C. PREPARATION OF WELL FOR SAMPLING

Amount of water removed before sampling: 45 gallons Did well go dry? X Yes ____ No

D. PHYSICAL APPEARANCE DURING SAMPLING

Color Tan/Brown Odor None Turbidity Moderate

Was an oil film or layer apparent? No

E. CONDUCTIVITY (~~micromhos~~) 3080 2890 2890 2910

F. pH 7.09 6.95 6.90 6.80

G. TEMPERATURE (°F) 70.5 66.3 65.0 64.5

H. WELL SAMPLING NOTES/COMMENTS _____

I. MONITORING WELL INTEGRITY CHECKLIST

Well identification number clearly marked?	Yes	(No)
Well covers and locks in good condition and secure?	(Yes)	No
Is the well stand pipe vertically aligned and secure?	(Yes)	No
Is the concrete pad and surface seal in good condition?	(Yes)	No
Are soils surrounding the well pad eroded?	Yes	(No)
Is the PVC well casing in good condition?	(Yes)	No
Is the measuring point on the PVC well casing clearly marked?	Yes	(No)
Is there standing water in the annular space between the well stand pipe and PVC casing?	Yes	(No)
Is the stand pipe vented at the base to provide drainage?	Yes	(No)
Does the total depth of the well sounded correspond with original well completion depths? N/A	Yes	No

GROUND WATER SAMPLING FIELD LOG

JOB NO: 2600.024

Sample Location: J.F. Queeny Plant, Monsanto Co. Well No.: REC-2 Sampled By: MBH/JJL

Date: 3 June 1993 Time: 1236 Weather: _____

Sampled With: X Bailer X Pump Completion: ____ Above Ground X Flush Mounted

A. WATER TABLE

Well Depth: (below top of casing) 60.65 ft. Well Elevation: (top of casing) _____ ft.

Depth to Water Table: (below top of casing) 7.1 ft. Water Table Elevation: _____ ft.

Length of Water Column (LWC): 53.55 ft.

Volume of Water in Well: 2" diameter wells = 0.163 x (LWC) = _____ gallons

4" diameter wells = 0.653 x (LWC) = 34.97 gallons x 3 = 104.9 gallons

6" diameter wells = 1.469 x (LWC) = _____ gallons

B. PHYSICAL APPEARANCE AT START

Color Clear to tan Odor yes Turbidity slight

Was an oil film or layer apparent? No

C. PREPARATION OF WELL FOR SAMPLING

Amount of water removed before sampling: 105 gallons Did well go dry? ____ Yes X No

D. PHYSICAL APPEARANCE DURING SAMPLING

Color Tan/Brown Odor Yes Turbidity moderate

Was an oil film or layer apparent? NO

E. CONDUCTIVITY (uS/cm) 7.25 / 6.82 / - / 6.99 / 6.65 / 7.17 / 7.03 / 6.99

F. pH 7.42 / 7.42 / - / 7.47 / 7.49 / 7.59 / 7.56 / 7.56

G. TEMPERATURE (°F) 69.5 / 66.8 / 66.8 / 66.8 / 67.0 / 67.1 / 67.2 / 67.2

H. WELL SAMPLING NOTES/COMMENTS _____

I. MONITORING WELL INTEGRITY CHECKLIST

Well identification number clearly marked?	Yes	(No)
Well covers and locks in good condition and secure?	(Yes)	No
Is the well stand pipe vertically aligned and secure?	(Yes)	No
Is the concrete pad and surface seal in good condition?	(Yes)	No
Are soils surrounding the well pad eroded?	Yes	(No)
Is the PVC well casing in good condition?	(Yes)	No
Is the measuring point on the PVC well casing clearly marked?	Yes	(No)
Is there standing water in the annular space between the well stand pipe and PVC casing?	Yes	(No)
Is the stand pipe vented at the base to provide drainage?	Yes	(No)
Does the total depth of the well sounded correspond with original well completion depths? N/A	Yes	No

GROUND WATER SAMPLING FIELD LOG

JOB NO: 2600.024

Sample Location: J.F. Queeny Plant, Monsanto Co. Well No.: REC-3 Sampled By: MBH/JSL

Date: 4 June 1993 Time: 1425 Weather: _____

Sampled With: X Bailer X Pump Completion: ____ Above Ground X Flush Mounted

A. WATER TABLE

Well Depth: (~~below top of casing~~ below Ground Surface) 62.9 ft. Well Elevation: (top of casing) _____ ft.

Depth to Water Table: (below ~~top of casing~~ Ground Surface) 10.25 ft. Water Table Elevation: _____ ft.

Length of Water Column (LWC): 52.65 ft.

Volume of Water in Well: 2" diameter wells = 0.163 x (LWC) = _____ gallons

4" diameter wells = 0.653 x (LWC) = 34.4 gallons x 3 = 103 gallons

6" diameter wells = 1.469 x (LWC) = _____ gallons

B. PHYSICAL APPEARANCE AT START

Color Clear Odor None Turbidity Slight

Was an oil film or layer apparent? No

C. PREPARATION OF WELL FOR SAMPLING

Amount of water removed before sampling: 105 gallons Did well go dry? ____ Yes X No

D. PHYSICAL APPEARANCE DURING SAMPLING

Color Clear Odor none Turbidity Slight

Was an oil film or layer apparent? No

E. CONDUCTIVITY 424 368 366 366

F. pH 8.76 8.8 8.81 8.84

G. TEMPERATURE 71.4 70.2 69.5 69.2

H. WELL SAMPLING NOTES/COMMENTS Standing water in the manhole had to be pumped out and kept Recharging. A hole was noted in the well casing in which water was entering the well from the manhole.

I. MONITORING WELL INTEGRITY CHECKLIST

Well identification number clearly marked?	Yes	(No)
Well covers and locks in good condition and secure? Flange Bolts Rusted Through.	(No) Yes	(No)
Is the well stand pipe vertically aligned and secure?	(Yes)	No
Is the concrete pad and surface seal in good condition?	(Yes)	No
Are soils surrounding the well pad eroded?	Yes	(No)
Is the PVC well casing in good condition? (Hole in the Casing)	no (Yes)	(No)
Is the measuring point on the PVC well casing clearly marked?	Yes	(No)
Is there standing water in the annular space between the well stand pipe and PVC casing?	(Yes)	No
Is the stand pipe vented at the base to provide drainage?	Yes	(No)
Does the total depth of the well sounded correspond with original well completion depths? N/A	Yes	No

GROUND WATER SAMPLING FIELD LOG

JOB NO: 2600.024

Sample Location: J. E. Queeny Plant, Monsanto Co Well No.: BEC-4 Sampled By: MBH/JJL

Date: 4 June 1993 Time: 1100 Weather: _____

Sampled With: x Bailer x Pump Completion: ____ Above Ground x Flush Mounted

A. WATER TABLE

Well Depth: (below ~~top of casing~~ Ground surface) 69.4 ft. Well Elevation: (top of casing) _____ ft.

Depth to Water Table: (below ~~top of casing~~ Ground surface) 10.1 ft. Water Table Elevation: _____ ft.

Length of Water Column (LWC): 59.3 ft.

Volume of Water in Well: 2" diameter wells = 0.163 x (LWC) = _____ gallons

4" diameter wells = 0.653 x (LWC) = 38.7 gallons x 3 = 116 gallons

6" diameter wells = 1.469 x (LWC) = _____ gallons

B. PHYSICAL APPEARANCE AT START

Color Clear Odor None Turbidity Slight

Was an oil film or layer apparent? No

C. PREPARATION OF WELL FOR SAMPLING

Amount of water removed before sampling: 120 gallons Did well go dry? ____ Yes x No

D. PHYSICAL APPEARANCE DURING SAMPLING

Color Tan/Brown Odor None Turbidity Moderate

Was an oil film or layer apparent? No

E. CONDUCTIVITY (uS/cm) 1521 1408 1362 1377 1386

F. pH 8.23 8.08 8.02 7.89 7.83

G. TEMPERATURE (°F) 71.6° 69.1° 67.7° 67.7° 67.7°

H. WELL SAMPLING NOTES/COMMENTS Standing water in manhole had to be pumped out prior to Sampling.

MONITORING WELL INTEGRITY CHECKLIST

Well identification number clearly marked?	Yes	(No)
Well covers and locks in good condition and secure?	(Yes)	No
Is the well stand pipe vertically aligned and secure?	(Yes)	No
Is the concrete pad and surface seal in good condition?	(Yes)	No
Are soils surrounding the well pad eroded?	Yes	(No)
Is the PVC well casing in good condition?	(Yes)	No
Is the measuring point on the PVC well casing clearly marked?	Yes	(No)
Is there standing water in the annular space between the well stand pipe and PVC casing?	(Yes)	No
Is the stand pipe vented at the base to provide drainage?	Yes	(No)
Does the total depth of the well sounded correspond with original well completion depths? N/A	Yes	No

GROUND WATER SAMPLING FIELD LOG

JOB NO: 2600.024

Sample Location: J. F. Queeny Plant, Monsanto Co. Well No.: MW-3 Sampled By: JJL

Date: 10 June 1993 Time: 1215 Weather: _____

Sampled With: X Bailer ____ Pump Completion: X Above Ground ____ Flush Mounted

A. WATER TABLE

Well Depth: (below top of casing) 31.8 ft. Well Elevation: (top of casing) _____ ft.

Depth to Water Table: (below top of casing) 10.2 ft. Water Table Elevation: _____ ft.

Length of Water Column (LWC): 21.6 ft.

Volume of Water in Well: 2" diameter wells = 0.163 x (LWC) = 3.5 gallons x3 = 10.5 gallons

4" diameter wells = 0.653 x (LWC) = _____ gallons

6" diameter wells = 1.469 x (LWC) = _____ gallons

B. PHYSICAL APPEARANCE AT START

Color Clear Odor None Turbidity Slight

Was an oil film or layer apparent? No

C. PREPARATION OF WELL FOR SAMPLING

Amount of water removed before sampling: 11 gallons Did well go dry? ____ Yes X No

D. PHYSICAL APPEARANCE DURING SAMPLING

Color Tan/Brown Odor None Turbidity Moderate

Was an oil film or layer apparent? NO

E. CONDUCTIVITY 885 836 882 914 898

F. pH 5.58 5.30 5.53 5.57 5.34

G. TEMPERATURE 64.5 63.6 62.0 63.0 62.7

H. WELL SAMPLING NOTES/COMMENTS _____

I. MONITORING WELL INTEGRITY CHECKLIST

Well identification number clearly marked?	Yes	No
Well covers and locks in good condition and secure?	Yes	No
Is the well stand pipe vertically aligned and secure?	Yes	No
Is the concrete pad and surface seal in good condition?	Yes	No
Are soils surrounding the well pad eroded?	Yes	No
Is the PVC well casing in good condition?	Yes	No
Is the measuring point on the PVC well casing clearly marked?	Yes	No
Is there standing water in the annular space between the well stand pipe and PVC casing?	Yes	No
Is the stand pipe vented at the base to provide drainage?	Yes	No
Does the total depth of the well sounded correspond with original well completion depths?	Yes	No

APPENDIX B

BORING LOGS

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	NUMBER: SB-1 SHEET 1 of 1
CLIENT: Monsanto Company PROJECT LOCATION: Monsanto Queeny Plant	GROUND WATER DATE DEPTH ELEVATION	FILE No.: 2600.024 DRILLING METHOD: SAMPLER TYPE: 2-1/4" HSA Split Spoon HAMMER: FALL:
O'BRIEN & GERE GEOLOGIST: LS Douglas BORING CO.: Layne Western FOREMAN:	BORING LOCATION: GROUND ELEVATION: DATES: STARTED: 06/10/93	RIG: TOC: ENDED: 06/10/93

DEPTH	Sample				SAMPLE DESCRIPTION	STRATUM CHANGE DEPTH	LITHOLOGY	EQUIPMENT INSTALLED	HNU
	No.	Depth	Blows /6"	Penetration/ Recovery					
1	1	0-2	17/26/12/7	2/1	3" Concrete Gravel with a little silty clay intermixed	Fill			—
2									
	2	2-4	8/8/9/6	2/0.8	Some gravel with brown silty clay	Fill			0.5
3									
4					Lab Sample				
	3	4-6	4/4/4/5	2/1	Stiff, dark brown-black silty clay with gravel intermixed	Fill			0.25
5									
6					Moist				
	4	6-8	2/4/5/6	2/2	Very stiff, high clay content silty clay; dark brown	CH			2
7					changing to brown				
8					Moist				
	5	8-10	3/5/7/6	2/2	Very stiff, brown, high clay content silty clay	CH			3
9									
10					Moist				
	6	10-12	2/4/4/6	2/2	Same as above	CH			3
11					Softer, increasing moisture				
12					Lab Sample				
	7	12-14	2/2/3/2	2/2	Soft, brown, high silt content, silty clay	CH/MH			1
13									
					Apparent saturated zone				
14									
					E.O.B. 14'				
15									

NOTES:

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	NUMBER: SB-2 SHEET 1 of 1
CLIENT: Monsanto Company PROJECT LOCATION: Monsanto Queeny Plant	GROUND WATER DATE DEPTH ELEVATION	FILE No.: 2600.024 DRILLING METHOD: SAMPLER TYPE: 2-1/4" HSA Split Spoon HAMMER: FALL:
O'BRIEN & GERE GEOLOGIST: LS Douglas BORING CO.: Layne Western FOREMAN:	BORING LOCATION: GROUND ELEVATION: DATES: STARTED: 06/10/93	RIG: TOC: ENDED: 06/10/93

DEPTH	Sample				SAMPLE DESCRIPTION	STRATUM CHANGE DEPTH	LITHOLOGY	EQUIPMENT INSTALLED	HNU
	No.	Depth	Blows /6"	Penetration/ Recovery					
1	1	0-2	1/2/4/50	2/0.2	Very poor sample recovery Gravel	Fill			
2									
	2	2-4	30/37/14/13	2/0.8	Rocks and gravel with some wet silty clay	Fill			400
3									
4					Lab Sample				
	3	4-6	2/3/2/2	2/0.8	Dark brown silty clay	CH/Fill			75
5									
6									
	4	6-8	1/60/-/-	2/0.8	Dark brown silty clay with gravel 18" concrete obstruction	CH/Fill			175
7									
8									
	5	8-10	4/6/9/10	2/2	Dark brown silty clay Lab sample and duplicate lab sample Labeled SB-6, 2'-4'	CH			175
9									
10									
	6	10-12	3/5/6/6	2/1.5	Same as above	CH			10
11									
12									
	7	12-14	2/2/3/4	2/2	High silt content, silty clay, brown and orange mottled Apparent saturated zone	CH/MH			15
13									
14									
					E.O.B. 14'				
15									

NOTES:

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	NUMBER: SB-3 SHEET 1 of 1
CLIENT: Monsanto Company PROJECT LOCATION: Monsanto Queeny Plant	GROUND WATER DATE DEPTH ELEVATION	FILE No.: 2600.024 DRILLING METHOD: SAMPLER TYPE: 2-1/4" HSA Split Spoon HAMMER: FALL:
O'BRIEN & GERE GEOLOGIST: LS Douglas BORING CO.: Layne Western FOREMAN:	BORING LOCATION: GROUND ELEVATION: DATES: STARTED: 06/10/93	RIG: TOC: ENDED: 06/10/93

DEPTH	Sample				SAMPLE DESCRIPTION	STRATUM CHANGE DEPTH	LITHOLOGY	EQUIPMENT INSTALLED	HNU
	No.	Depth	Blows /6"	Penetration/ Recovery					
1	1	0-2	16/14/-/-	2/0.5	Gravel and concrete to 2.5'	Fill			0
					Poor sample recovery				
2									
3	2	2.5-4.5	2/2/1/3	2/0.5	Dark brown/black, unconsolidated, soft, silty clay and	Fill			2
					gravel, poor sample recovery				
4					Apparent saturated zone				
5	3	4.5-6.5	2/3/7/8	2/0.5	Same as above with brick shards, sheen on water, poor sample	Fill			3
					recovery				
6					Apparent saturated zone				
7	4	6.5-8.5	4/8/14/6	2/1	Dark brown/black, unconsolidated, soft, silty clay, gravel	Fill			10
					and sand				
8					Apparent saturated zone				
					Lab Sample				
9	5	8.5-10.5	1/3/3/4	2/2	8.5 to 9.5 same as above	Fill			7
					9.5 to 10.5 orange and brown mottled soft silty clay	CH			
10					Apparent saturated zone				
11	6	10.5-12.5	1/2/3/2	2/2	Soft orange and brown mottled silty clay	CH			2
					Apparent saturated zone				
12					Lab Sample				
					E.O.B. 12'				
13									
14									
15									

NOTES: After augers withdrawn from borehole, standing water 18" from grade.

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	NUMBER: SB-4 SHEET 1 of 1
CLIENT: Monsanto Company PROJECT LOCATION: Monsanto Queeny Plant	GROUND WATER DATE DEPTH ELEVATION	FILE No.: 2600.024 DRILLING METHOD: SAMPLER TYPE: 2-1/4" HSA Split Spoon HAMMER: FALL:
O'BRIEN & GERE GEOLOGIST: LS Douglas BORING CO.: Layne Western FOREMAN:	BORING LOCATION: GROUND ELEVATION: DATES: STARTED: 06/10/93	RIG: TOC: ENDED: 06/10/93

DEPTH	Sample No.	Sample Depth	Sample Blows /6"	Sample Penetration/ Recovery	SAMPLE DESCRIPTION	STRATUM CHANGE DEPTH	LITHOLOGY	EQUIPMENT INSTALLED	HNU
1	1	0-2	2/14/15/14	2/0.8	Gravel	Fill			5
2									
	2	2-4	3/3/6/4	2/2	Dark brown silty clay with some wet gravel	Fill			4
3									
4					Lab Sample				
	3	4-6	3/4/6/6	2/2	Dark brown, very stiff, silty clay	CH			1
5					High clay content				
6									
	4	6-8	3/5/7/9	2/2	Very stiff, dark brown, silty clay	CH			1
7									
8									
	5	8-10	2/6/8/16	2/2	Same as above	CH			3
9									
					Lab Sample				
10					Equipment blank taken after this sample retrieved				
	6	10-12	3/5/5/6	2/2	Softer, higher silt content	CH/MH			0.5
11					Brown silty clay with rust colored mottling throughout				
12									
	7	12-14	1/2/2/3	2/2	Soft brown, silty clay with rust colored mottling	CH/MH			0.5
13					High silt content				
					Apparent saturated zone				
14									
					E.O.B. 14'				
15									

NOTES:

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	NUMBER: SB-5 SHEET 1 of 1
CLIENT: Monsanto Company PROJECT LOCATION: Monsanto Queeny Plant	GROUND WATER DATE DEPTH ELEVATION	FILE No.: 2600.024 DRILLING METHOD: SAMPLER TYPE: 2-1/4" HSA Split Spoon HAMMER: FALL:
O'BRIEN & GERE GEOLOGIST: LS Douglas BORING CO.: Layne Western FOREMAN:	BORING LOCATION: GROUND ELEVATION: DATES: STARTED: 06/10/93	RIG: TOC: ENDED: 06/10/93

DEPTH	Sample				SAMPLE DESCRIPTION	STRATUM CHANGE DEPTH	LITHOLOGY	EQUIPMENT INSTALLED	HNU
	No.	Depth	Blows /6"	Penetration/ Recovery					
1									
	1	0.5-2.5	6/7/2/4	2/1	6" Concrete/asphalt	Fill			0
2					Fill, gravel and silty clay				
3	2	2.5-4.5	1/1/2/2	2/1	Dark brown silty clay	CH			5
					Moist				
4									
					Lab Sample				
5	3	4.5-6.5	1/2/2/3	2/1.5	Same as above	CH			1
					Moist				
6									
7	4	6.5-8.5	2/2/4/6	2/2	Stiff, brown, dark brown and orange mottled silty clay	CH			0.5
					Moist				
8									
9	5	8-10	2/4/5/6	2/2	Very stiff, dark brown silty clay	CH			1
10									
11	6	10.5-12.5	3/4/5/6	2/2	Soft, high silt content, dark brown silty clay	CH/MH			4
					Increasing moisture				
12					Lab Sample				
13	7	12.5-14.5	1/1/2/2	2/2	Soft, high silt content, silty clay	CH/MH			3
					Apparent saturated zone				
14									
15					E.O.B. 14.5'				

NOTES:

APPENDIX C

GEOTRACE, INC. REPORT

O'BRIEN & GERE ENGINEERS, INC.
5000 CEDAR PLAZA PARKWAY
SUITE 211
ST. LOUIS, MO 63128

LOCATION:
MONSANTO CHEMICAL COMPANY
ST. LOUIS, MO

GEO TRACE, INC.

environmental service company

RECEIVED

JUN 04 1993

O'Brien & Gere Engineers, Inc.
St. Louis, MO

PROJECT: Monsanto Chemical Company
St. Louis, MO

CLIENT: O'Brien & Gere Engineers, Inc.
5000 Cedar Plaza Parkway, Suite 211
St. Louis, MO 63128

SAMPLE DATE: May 27-28, 1993

REPORT DATE: May 31, 1993

REPORT NUMBER: 9306440

This report summarizes groundwater sampling activities along with on-site headspace analyses at the above-referenced site. Groundwater samples were obtained by utilizing a ball and seat sampler attached to polytubing.

The static headspace method was utilized for all on-site groundwater analyses. All vapor samples were directly injected into a Shimadzu GC-14A and specific contaminant concentrations were calculated by a Shimadzu CR-4A computer integrator using a Flame Ionization Detector and an Electron Capture Detector (FID/ECD). A total of seventeen (17) samples were analyzed for trichloroethene (TCE) and tetrachloroethene (PCE). Proven laboratory procedures were employed for quality assurance/quality control, including periodic blanks and calibration standards.

The static headspace method utilized is a proven method for field screening of volatile organic compounds. Although at times results may prove similar to other laboratory methods, they may also prove to differ. The analytical procedure is one which provides a rapid screening for the targeted compounds with reproducible results.

Mr. Matthew Hudson of O'Brien & Gere Engineers, Inc. was present and directed sampling activities.

Upon reviewing the following results, please do not hesitate to call with any questions. Thank you for choosing Geo Trace, Inc. (GTI) for your project.

P.O. BOX 1243 MT. VERNON, ILLINOIS 62864 618-244-7900 FAX 618-244-7999
P.O. BOX 95 WENTZVILLE, MISSOURI 63385 314-327-7911 FAX 314-327-7979

O'BRIEN & GERE ENGINEERS, INC.
ST. LOUIS, MO

MONSANTO CHEMICAL COMPANY
ST. LOUIS, MO

REPORT # 9306440

LOCATION	GP1	GP2	GP3	GP3 DUP
TYPE	GROUNDWATER	GROUNDWATER	GROUNDWATER	GROUNDWATER
DEPTH TO SCREEN	22'	24'	15'	15'
DEPTH TO GW IN PROBE R	15'	13'	7.5'	7.5'
TCE	341	10,785	2	2
PCE	151	3,880	7	7
		*		

LOCATION	GP4	GP5	GP6	GP7
TYPE	GROUNDWATER	GROUNDWATER	GROUNDWATER	GROUNDWATER
DEPTH TO SCREEN	21'	21'	27'	24'
DEPTH TO GW IN PROBE R	14'	14'	24'	13.5'
TCE	21	574	45,974	1,042
PCE	28	890	5,486	3,220
			*	*

LOCATION	GP8	GP9	GP10	GP11
TYPE	GROUNDWATER	GROUNDWATER	GROUNDWATER	GROUNDWATER
DEPTH TO SCREEN	29'	21'	21'	25'
DEPTH TO GW IN PROBE R	17.5'	10.5'	14'	13'
TCE	37,840	2,736	771	18,414
PCE	9,416	414	144	221
	*	*	*	*

BMDL= BELOW METHOD DETECTION LIMIT
ALL RESULTS REPORTED IN PARTS PER BILLION
DETECTION LIMIT 1 PPB PER ANALYTE
* = OTHER UNKNOWN ANALYTES

LOCATION	GP12	GP14	GP16	GP18
TYPE	GROUNDWATER	GROUNDWATER	GROUNDWATER	GROUNDWATER
DEPTH TO SCREEN	23'	21'	23'	23'
DEPTH TO GW IN PROBE R	12'	10.5'	9.2'	13'
TCE	5,442	12	337	132
PCE	3,883	12	12,486	36

LOCATION	GP20	GP21		
TYPE	GROUNDWATER	GROUNDWATER		
DEPTH TO SCREEN	21'	24'		
DEPTH TO GW IN PROBE R	19'	15.7'		
TCE	478	3,563		
PCE	23	4,360		
		*		

BMDL= BELOW METHOD DETECTION LIMIT
ALL RESULTS REPORTED IN PARTS PER BILLION
DETECTION LIMIT 1 PPB PER ANALYTE
* = OTHER UNKNOWN ANALYTES

LOCATION	GP12	GP14	GP16	GP18
TYPE	GROUNDWATER	GROUNDWATER	GROUNDWATER	GROUNDWATER
DEPTH TO SCREEN	23'	21'	23'	23'
DEPTH TO GW IN PROBE R	12'	10.5'	9.2'	13'
TCE	5,442	12	337	132
PCE	3,883	12	12,486	36

LOCATION	GP20	GP21		
TYPE	GROUNDWATER	GROUNDWATER		
DEPTH TO SCREEN	21'	24'		
DEPTH TO GW IN PROBE R	19'	15.7'		
TCE	478	3,563		
PCE	23	4,360		
		*		

BMDL= BELOW METHOD DETECTION LIMIT
ALL RESULTS REPORTED IN PARTS PER BILLION
DETECTION LIMIT 1 PPB PER ANALYTE
* = OTHER UNKNOWN ANALYTES